

Water Quality Status and Trends in the Clark Fork-Pend Oreille Watershed 1984-2002

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The Clark Fork-Pend Oreille Watershed

- 26,000 mi.² drainage area
- includes Clark Fork of the Columbia River, Pend Oreille Lake, Pend Oreille River
- includes 2 EPA Regions, 3 states, 14 counties, several Indian reservations

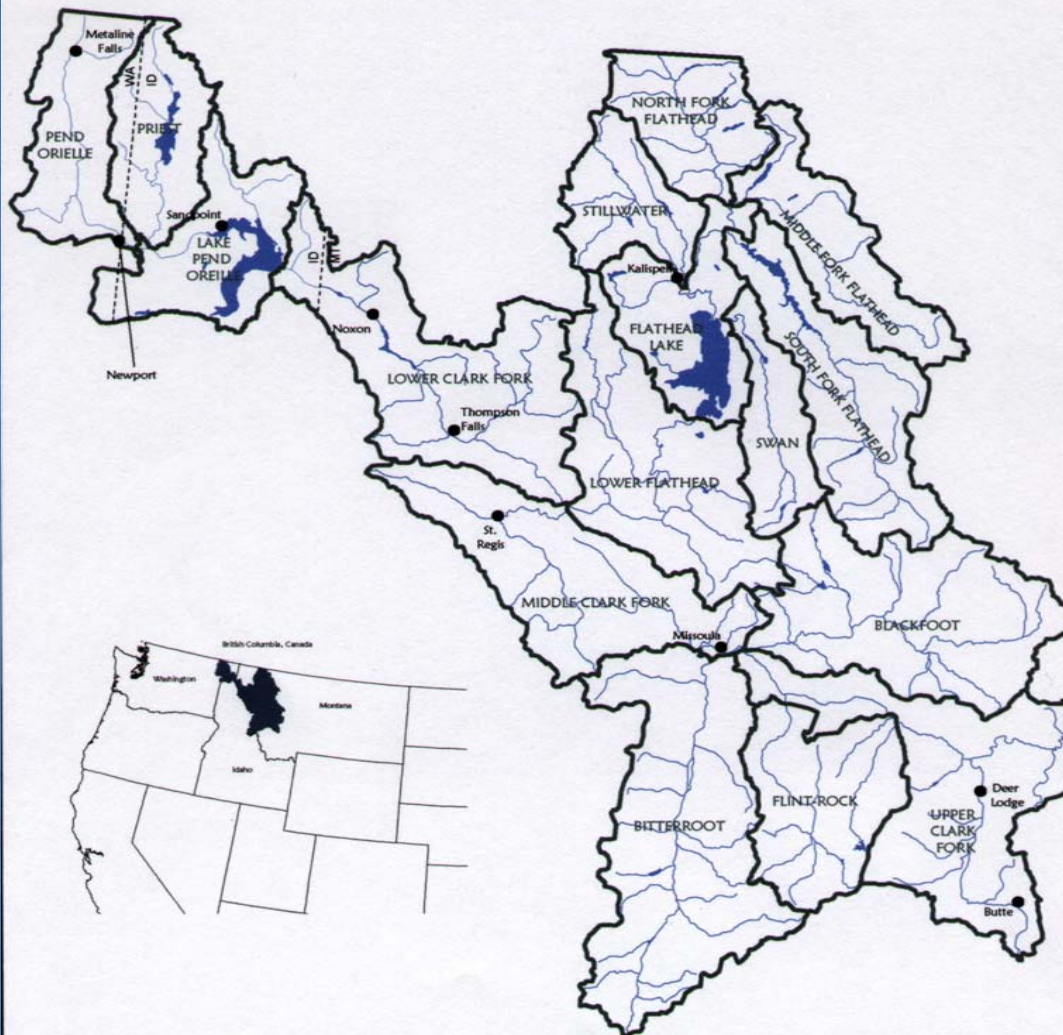


Figure 2.
Watershed Boundaries

Clark Fork-Pend Oreille Basin



25 0 25 50 Miles

Project#: 100-324

Date: March 2001

Location: Clark Fork-Pend Oreille Basin

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Tri-State Water Quality Council

History & Mission

- Formed in 1993 to address interstate water quality issues in the three-state watershed
- Primary interstate issue is nutrients & eutrophication
- Secondary issue is heavy metals toxicity
- Mission: ... "Citizens, business, industry, government and environmental groups are united" ... "to improve water quality" ... "through mutual respect, collaboration, science and education."

Tri-State Water Quality Council Management Goals

- Control nuisance algae in the Clark Fork by reducing nutrient concentrations
- Protect Pend Oreille Lake by maintaining or reducing nutrient loading from the Clark Fork R.
- Reduce near-shore eutrophication in Pend Oreille Lake by reducing non-point nutrient loading
- Improve Pend Oreille River water quality through aquatic weed management and tributary non-point source controls



Tri-State Water Quality Council Management Plan Elements

- Basin-wide nutrient management plan
- Clark Fork voluntary nutrient reduction plan (TMDL)
- MT-ID Pend Oreille Lake nutrient loading agreement
- Pend Oreille Lake management plan (TMDL)
- Public involvement & education
- Basin-wide monitoring plan

Monitoring Program Goals

Clark Fork River –

- evaluate time trends for nutrient concentrations
- evaluate time trends for periphyton standing crops
- evaluate compliance with mid-summer nutrient concentration targets

Monitoring Program Goals

Pend Oreille Lake –

- estimate annual nutrient loads via Clark Fork River
- evaluate time trends for near-shore periphyton standing crops
- evaluate time trends for Secchi transparency

Pend Oreille River –

- evaluate time trends for nutrient concentrations & fecal coliform bacteria

Water Quality Trends Analysis

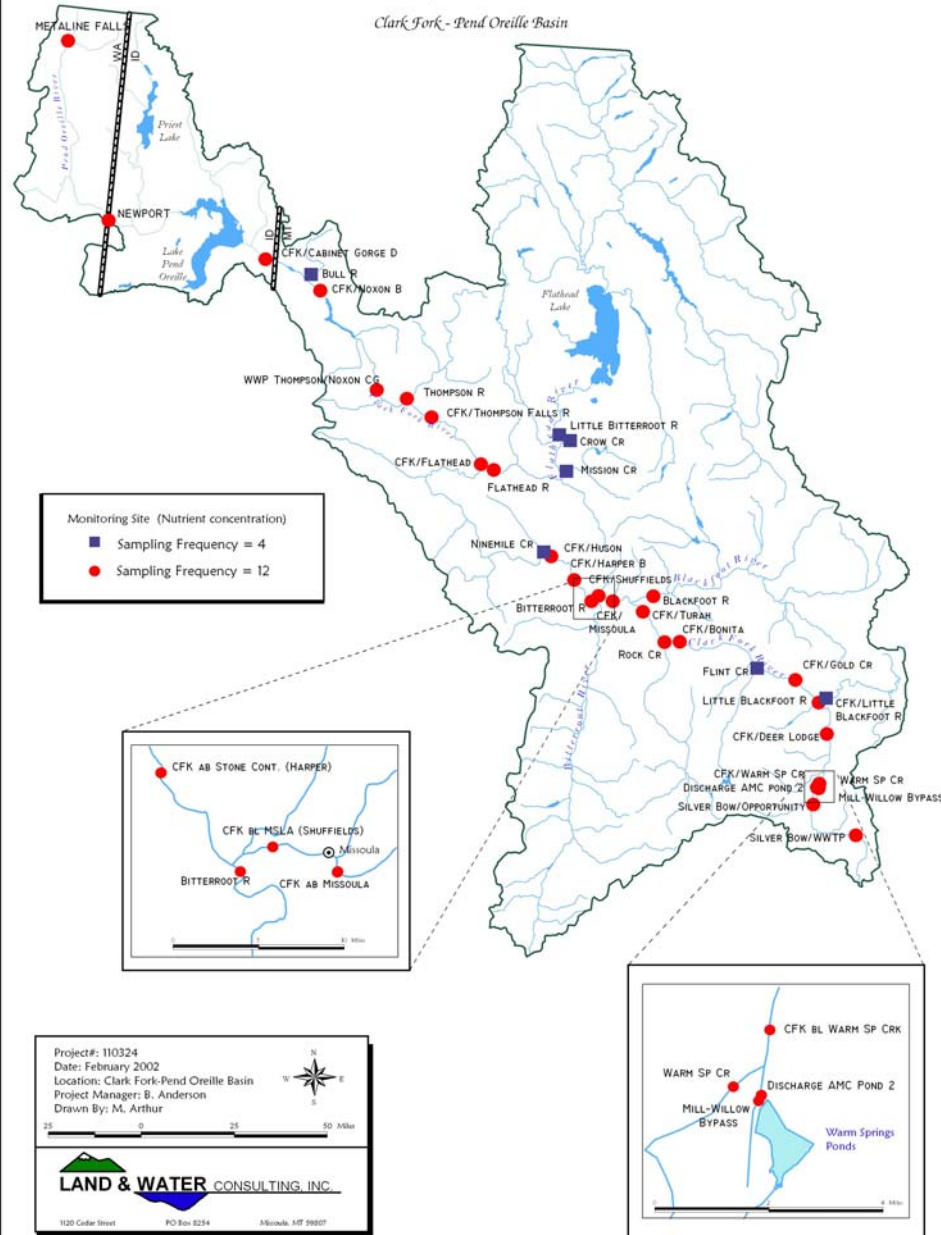
- 19-year data set available from Tri-State Council and former MT DEQ monitoring programs
- 10-year evaluation of tri-state management plan & 5-year evaluation of VNRP
- results will be used to evaluate progress & adjust management plan

Clark Fork River Nutrient Trend Detection

Management Goal:	Improve water quality
Monitoring Goal:	Detect significant trends in nutrient concentrations
Definition of Water Quality:	Total phosphorus, total nitrogen, soluble reactive phosphorus, total soluble inorganic nitrogen
Definition of Trend:	50% change in 10-year period at 95% confidence level, 90% power or 40% change at 90% C.L., 80% power
Statistical Methodology:	Seasonal Kendall with Sen slope estimate
Statistical Hypothesis:	Ho: No trend exists Ha: Trend exists
Data Analysis Result:	Conclusions regarding presence of trends; Provide estimate of trend magnitude
Information Product:	Management goal met when no trend exists, or indicates improvement

Figure 3.
Nutrient Concentration
Monitoring Sites in Montana

Clark Fork - Pend Oreille Basin



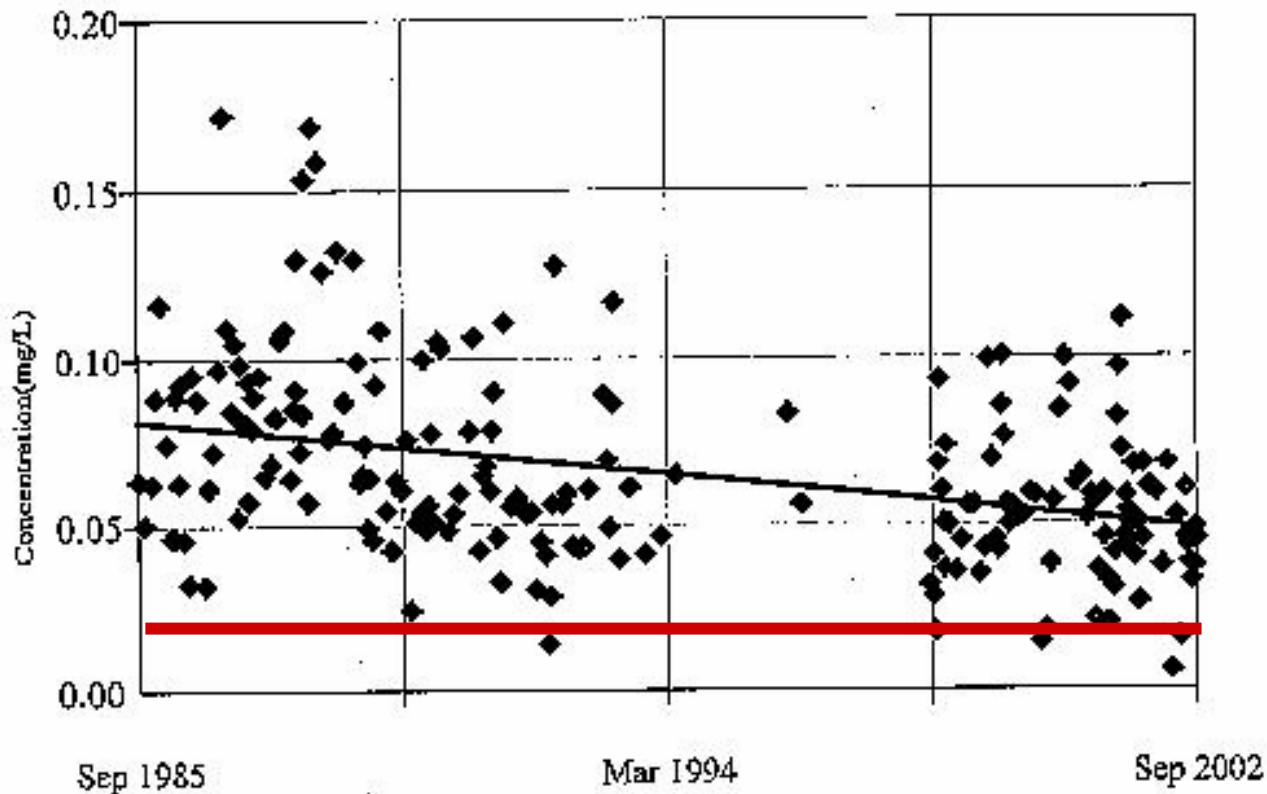
Number of Statistically Significant Parameter/Flow Correlations

	Positive (+)	Negative (-)	% Significant
Total			
Total P	21	0	63%
Total N	13	4	52%
Total Cu	20	0	61%
Total Zn	14	0	42%
Dissolved			
TSIN	3	11	42%
SRP	14	2	48%
Flow	3	9	36%

Number of Statistically Significant Trends

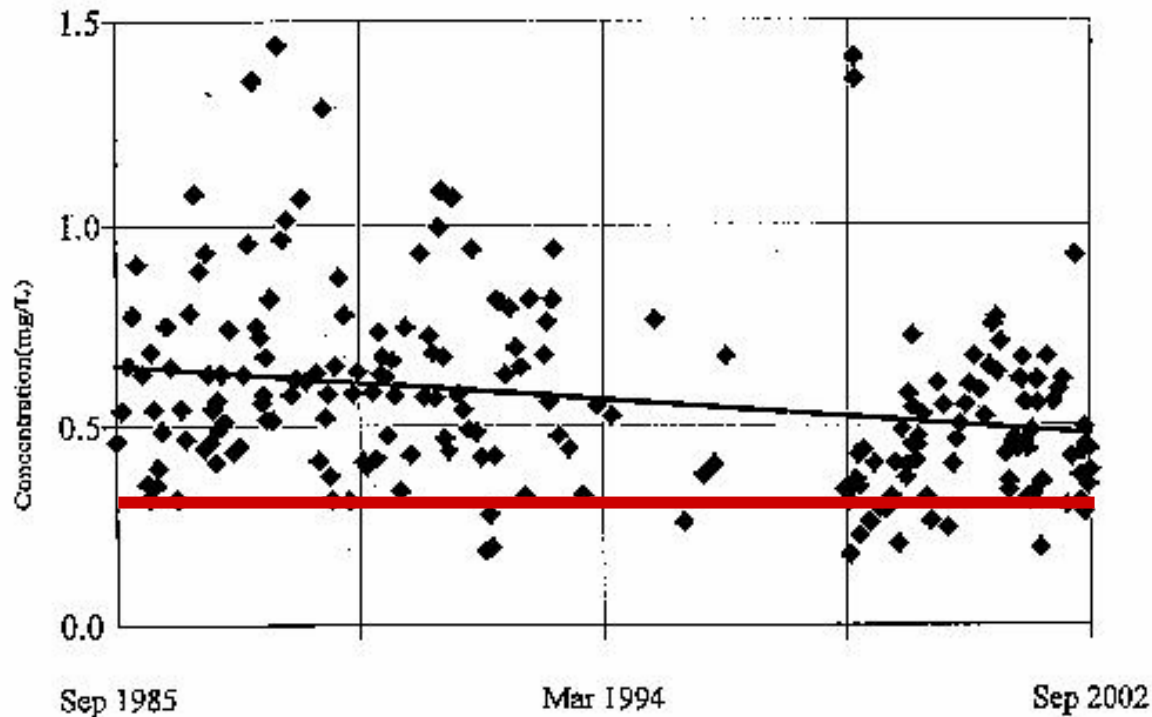
	Positive (+)	Negative (-)	% Total
Total			
Total P	1	14	43%
Total N	0	15	43%
Total Cu	3	4	20%
Total Zn	3	5	23%
Dissolved			
TSIN	14	4	51%
SRP	2	17	57%

Clark Fork below Deer Lodge – Total Phosphorus



- Highly significant downward trend

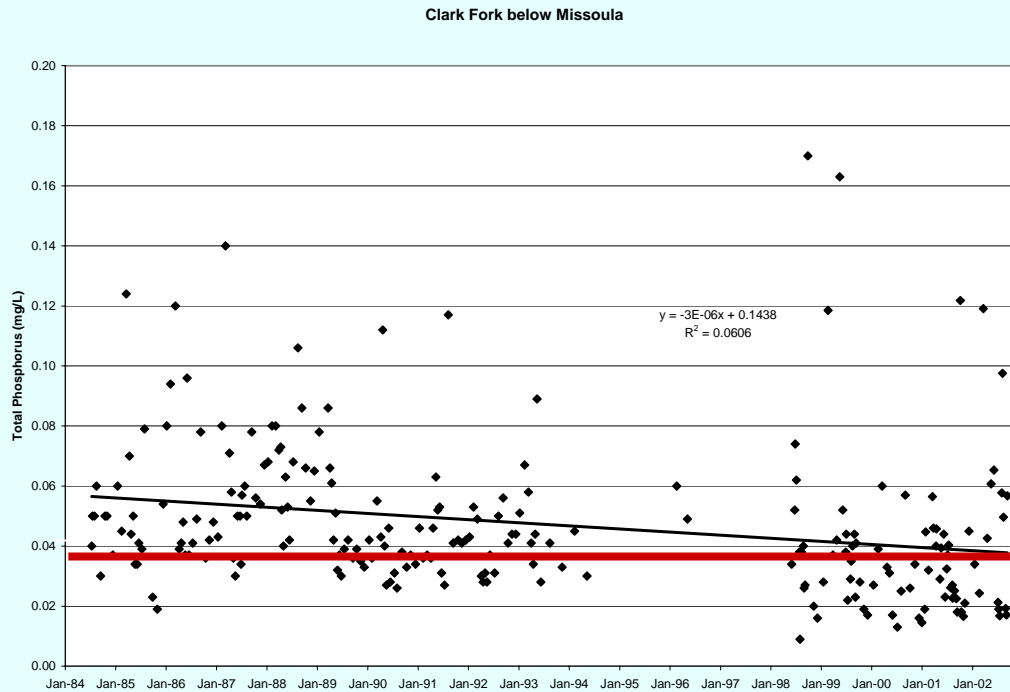
Clark Fork below Deer Lodge – Total Nitrogen



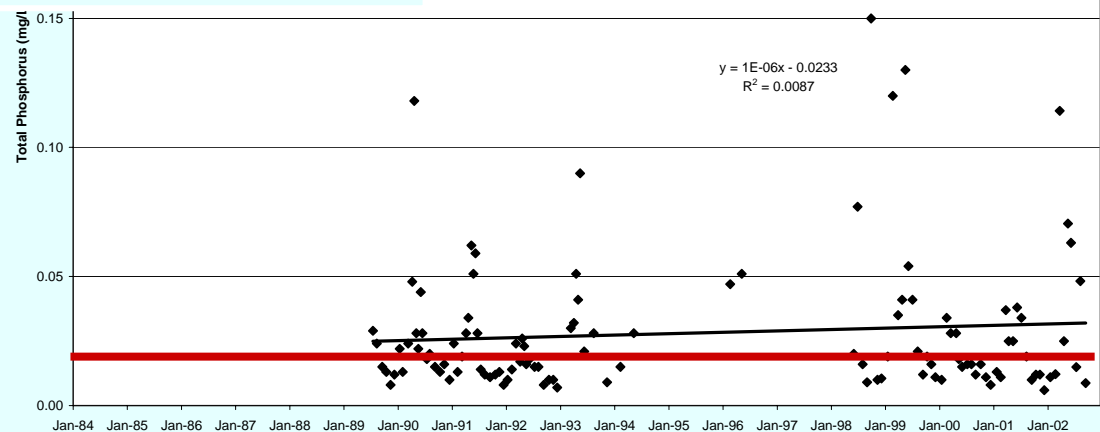
- Highly significant downward trend

Clark Fork below vs. above Missoula – Total Phosphorus

- Highly significant downward trend below Missoula (30-40% total reduction)

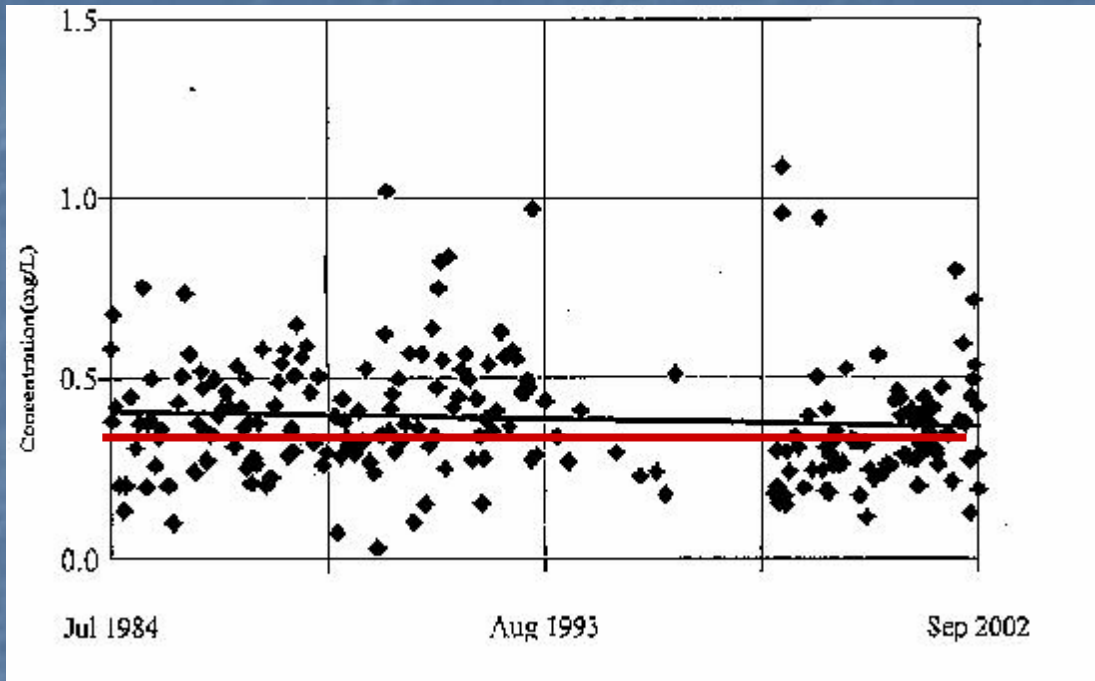


Clark Fork above Missoula



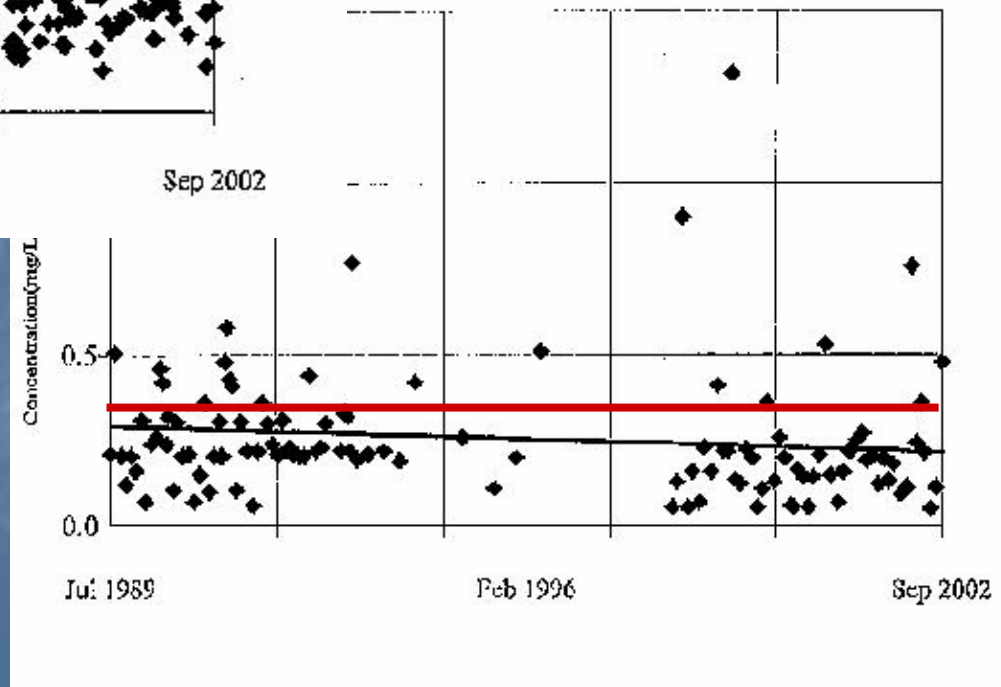
- No significant trend was present above Missoula

Clark Fork below vs. above Missoula – Total Nitrogen

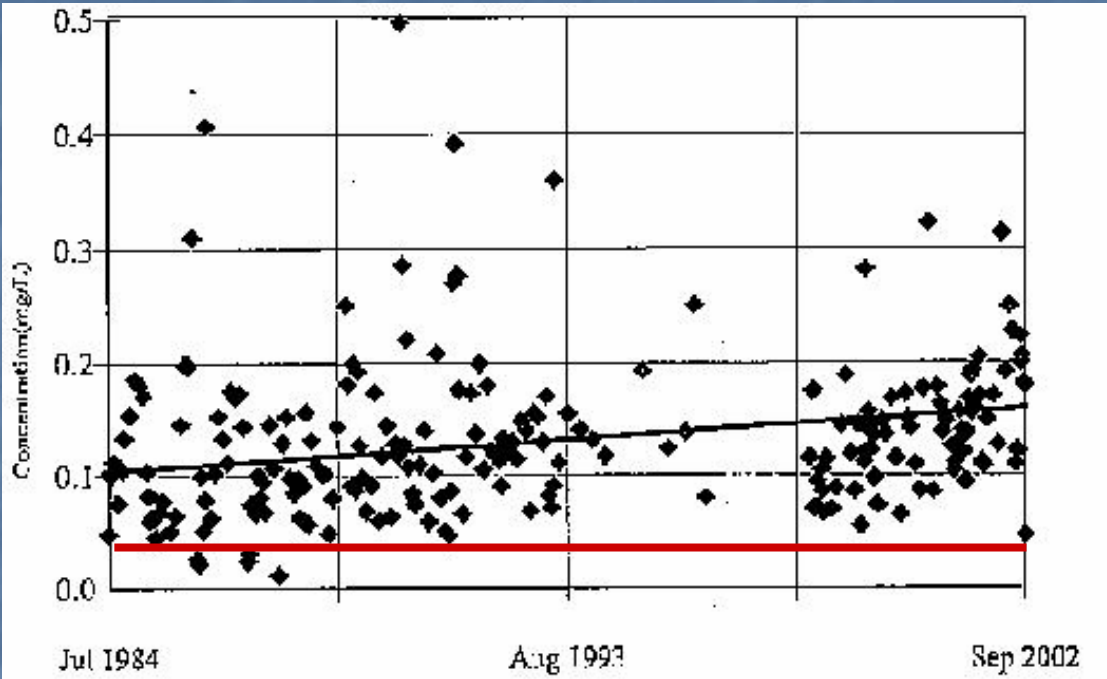


- No significant upward or downward trend below Missoula

- Moderately significant downward trend above Missoula

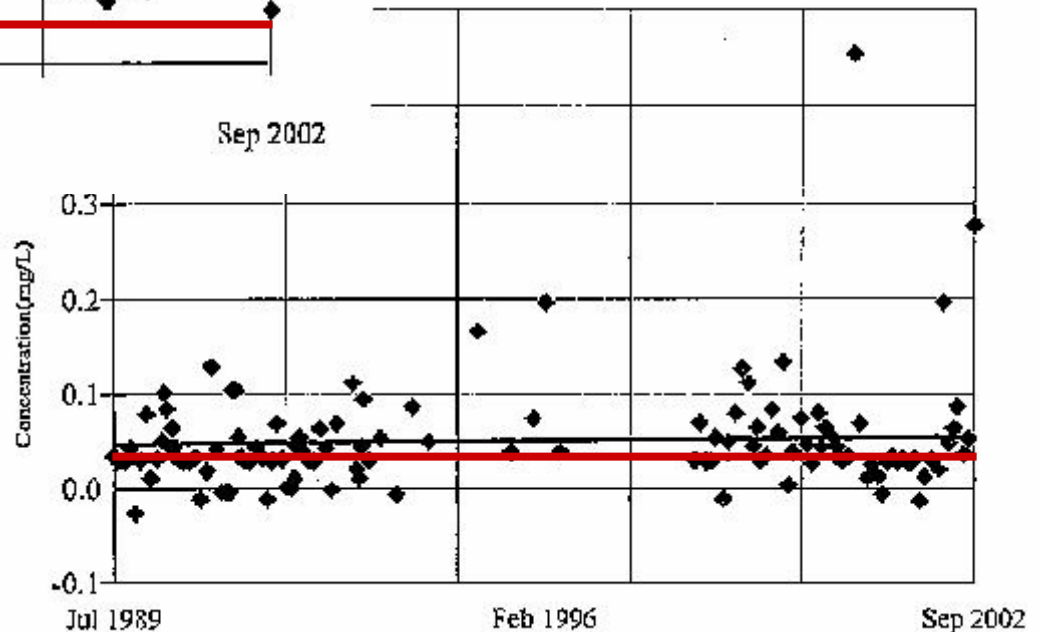


Clark Fork below vs. above Missoula – Dissolved Nitrogen

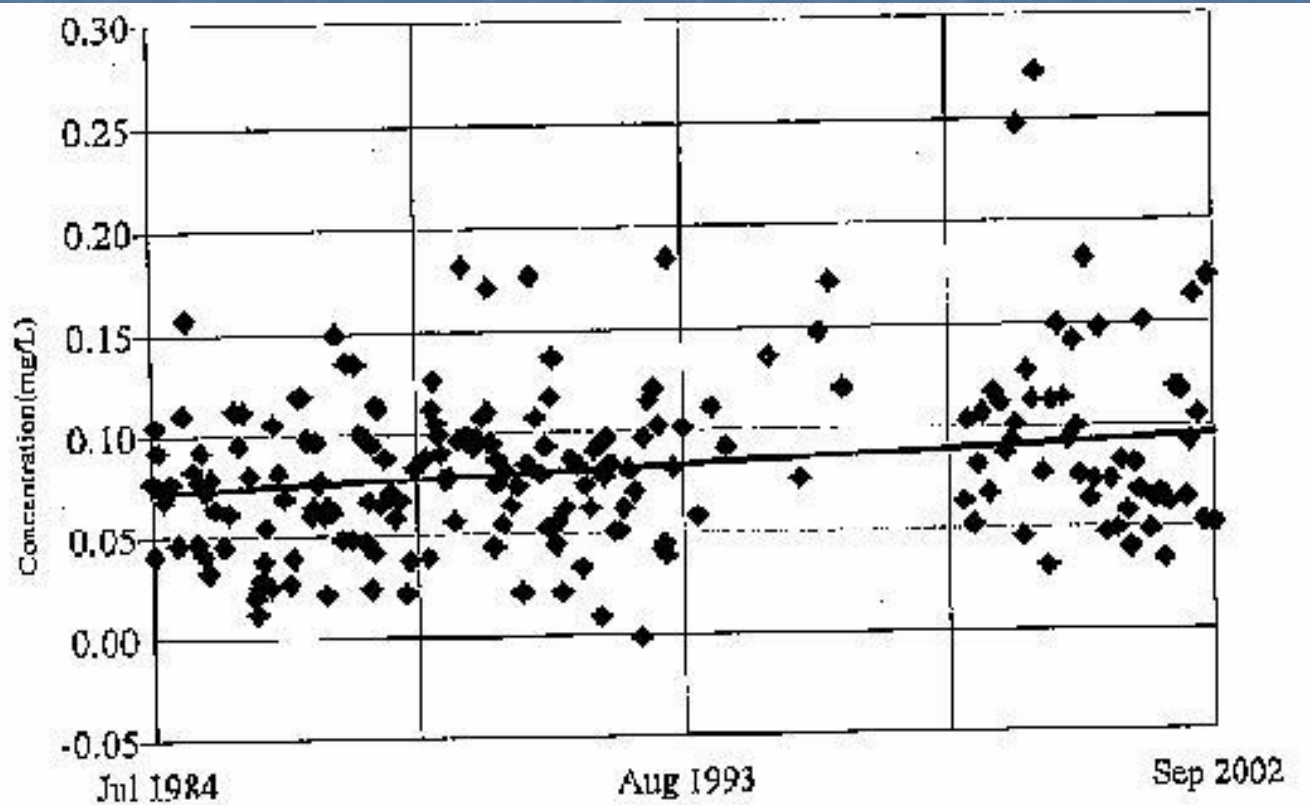


- Highly significant upward trend below Missoula

- No significant upward or downward trend above Missoula



Bitterroot River – Dissolved Nitrogen



- Highly significant upward trend

Conclusions – Clark Fork River

- Concentrations for most nutrient variables have declined in response to management actions
- Summer nutrient concentrations are approaching targets but are not yet in compliance at most stations
- Trend slopes suggest P targets will be attained at most stations within a few years
- Soluble N concentrations are increasing in the middle segments of the river in response to development activities

Application of Results – Connecting the Feedback Loop

- Management measures have been effective at improving water quality throughout much of the river
- At the same time, local & regional development activities are offsetting some of these improvements & are compromising the ability to achieve WQ goals
- Basin-wide nutrient management plan assumptions & elements will need to be adjusted to place more emphasis on growth issues
- Results will be used to fine-tune the monitoring program

Some Lessons Learned

- A long-term trends monitoring program applied at the watershed scale can be invaluable in documenting effectiveness of management actions & and in detecting emerging problems early on
- This program has helped the Council to establish trust among stakeholders & neutralize contentious issues
- The program has provided a means to educate basin residents & stakeholders, elicit cooperation, give credit to partners, & demonstrate commitment to downstream neighbors
- Despite the best monitoring design efforts, the answers won't always be cut & dried

